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FLOOD RISK AND ASSET MANAGEMENT**Progress Note 2 – Phase 1****15.06.2011***Document Information*

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1. *Progress statement*

A project initiation meeting was held in Philadelphia on 28th October 2010. One of the main items discussed was planning for the knowledge exchange workshop. The knowledge exchange workshop took place from 1st-3rd February when a delegation from the USACE visited HR Wallingford. The finalised minutes of the workshop are provided in Appendix 1.

One of the primary outputs from the knowledge exchange workshop was a decision relating to the pilot site application. It has been agreed the pilot site is St Paul's Minnesota, with the model extents shown in Figure 1.



Figure 1 Proposed extent of pilot site at St Paul's, Minnesota.

Following the workshop, a wide range of data (hydraulic models, topography, reliability analysis, and economic analysis), specific to St Paul's was passed from the Corps to HR Wallingford. HR Wallingford has undertaken initial Reliability modelling and Breach modelling and prepared the datasets for the flood risk analysis modelling.

The next stages in the project, until the end of July, are described below:

- HR Wallingford to complete preliminary flood risk analysis.
- Undertake telephone conference with USACE team to discuss initial results and plan activities for the upcoming US visit (end June)
- HR Wallingford to visit US to discuss modelling results, handover software and plan further activities – week beginning 25th July.

Following the July meeting, further activities are currently envisaged as HR Wallingford hosting a further visit from USACE, to finalise any software technicalities, discuss final modelling results and final reporting requirements.

2. *Financial*

Contract amount	\$259,337
Invoiced to date	\$129,668
Outstanding	\$129,669

Appendix 1 Minutes of Knowledge Exchange Workshop



HR Wallingford and USACE Workshop :
Flood risk, levee safety and asset management
HR Wallingford, Tuesday 1st February - Thursday 3rd February, 2011

Minutes (Final)

Attendees:

USACE

Noah Vroman (NV)
David Schaaf (DS)
Corby Lewis (CL)
Bob Patev (BP)
Neil Schwanz (NS)
William Lehman (WL)
David Margo (DM)
Alex Roos (AR)

HR Wallingford

Jonathan Simm (JS)
Caroline McGahey (CM)
Mark Morris (MM)
Mike Panzeri (MP)
Paul Sayers (PS)
Andy Tagg (AT)
Ben Gouldby (BG)

Workshop Objective:

The objectives of the workshop are summarised under two components:

1. Exchange knowledge on levee safety, flood risk and asset management.
2. Develop and define a detailed work-plan (activities and programme) for implementing methods and software tools at agreed locations to produce specific agreed outputs.

These activities are to support USACE in the development of their methodology for prioritisation of maintenance activities for risk reduction. It is currently envisaged the USACE will develop a framework that is not prescriptive with regard to modelling tools and implementation but provides overarching guidance on principles and concepts.

Summary of discussions (Days 1 and 2)

A series of presentations from all parties took place, the topics were wide ranging and included:

- Condition inspection
- Deterioration
- Geotechnical stability
- Closure (active) structures
- Fragility/reliability
- Levee deterioration
- Breaching and breach modelling
- Risk, uncertainty and sensitivity analysis
- Economic consequences of flooding
- Loss of life from flooding
- Hydraulic modelling
- Screening tools
- Optimisation
- Life cycle modelling and continuous simulation

There were many commonalities between the approaches used and in particular common definitions of risk, use of fragility, concepts of screening tools, condition inspection and uncertainty. The differences lay in the specific practical implementation and these were largely a result of different overarching policy and regulation requirements.

Specific actions arising from discussions on Day 1 and 2 are summarised below:

Action DM to provide paper on levee screening approach (and manual?)

Action DS to provide information on unified toolbox for internal erosion and piping

Action BG to provide information on capping of damages

Action BG to provide information on handling of deprivation in consequence analysis, in relation to WL's current research.

Action HRW to circulate draft paper on continuous simulation to WL.

Summary of discussions (Day 3)

During the morning of day 3 software demonstrations took place in particular in relation to the Wallingford risk analysis and decision support tool and the Process based HR Breach model.

In the afternoon, breakout discussions were held to confirm priorities of implementing tools, details of programme of work and points of contact. The outcomes of the discussions are summarised below.

It was agreed that St Paul's would be the focus for the pilot site analysis and trials. It was noted however, that a single site wouldn't cover a full range and provide a full test for the models. An option to overcome this issue was to experiment with different

modifications to the St. Paul's site (eg, modify defence crest levels to facilitate more damage). The primary model applications and outcomes of interest are described below:

Risk analysis model:

As a general principle it was agreed that the main focus of effort should be on implementing the software as is rather than make extensive changes to the Wallingford pre-processing tools for example, to be compatible with USACE data sets.

It was agreed to run the UK risk analysis model on the St Paul's area. The standard outputs the HR Wallingford risk analysis model currently produces are:

- Maps showing EAD over the floodplain area
- Maps showing floodplain EAD attributed to levee sections
- Maps showing annual probability of exceedence over the floodplain area

During the discussions it became apparent that loss of life is a key metric for USACE applications. There was some discussion on whether to include HRW's Dynamic (as opposed to static) Rapid Flood Spreading Model (RFSM) in the risk analysis model. It was felt however, that this may compromise runtimes and that a simple topographically based approach would suffice for the current study. This will mean additional output will become available:

- Expected life loss (ie risk of life loss) over the floodplain area
- Expected life loss attributed to levee sections

Action HRW, to implement simple loss of life approach. WL can provide input and advise on USACE LIFESIM approaches.

To enable comparison with HEC FRM approaches, it was agreed it would be useful to undertake single hydrodynamic simulations for specific realisations (ie single hydrographs and system state combinations). Model cascade could include HEC-RAS, HR BREACH and Dynamic RFSM. **Action HRW** to consider model coupling and advise DM.

It was felt useful to undertake the risk analysis using the UK "generic" fragility curves and compare the results with the site specific fragility curves that have already been derived by USACE. This will provide information that is useful for understanding issues of transferability to other sites (ie, do the generic curves act as a reasonable first pass, without having to undertake detailed reliability analysis for each defence).

Action HRW to set up risk analysis model on the St. Paul's study site and undertake analysis as described above.

Breach process model:

It was felt that it would be of benefit to explore the application of the Breach process model. **Action HRW** to configure breach model for the St Paul study site ready for transfer to USACE.

RELIABLE: It was felt that it would be of benefit to apply the RELIABLE model to compare with fragility curves that have already pr. **Action HRW** to configure RELIABLE model for the St Paul study site.

RAFT: The USACE screening tool is similar to the UK RAFT model. It was felt there would be merit in comparing the two tools in the context of the St Paul's area. Nb: HRW has developed the RAFT tool for the Environment Agency (EA) and its

application on St Paul's will require consent from the EA. **Action HRW** to enquire with the EA about use of the tool on St Paul's.

Full uncertainty analysis: Whilst this was an area of interest, this was considered as a lower priority than tasks above and will not be applied as a specific priority at St. Paul's.

Automated intervention optimisation: This current HRW research initiative was of interest, but it was felt this was at a too early stage and of less relevance for the Corp's current project. This will not be implemented at St. Paul's.

Timescales

A number of key milestones were identified together with associated timescales:

1. HRW visit to St Paul's – The primary objectives of this trip are:
 - a. HRW site familiarisation
 - b. Presentation of initial results
 - c. Transfer and training of software

Date: Provisionally agreed as early May 2011 – **Action BG** to contact DM and confirm dates.

2. USACE visit to HRW– The primary objectives of this trip are:
 - a. Familiarisation of approaches for wider group of USACE personnel.
 - b. Presentation and discussion of updated results.
 - c. Troubleshooting software
 - d. Final software transfer

Date: Provisionally agreed as end June 2011 – **Action:** BG to contact DM and confirm dates.

3. Final USACE reporting: August 2011.

Communication

It was felt most efficient for points of contact (POC) to be identified and direct communications on specific technical issues to occur, keeping BG and DM cc'd. POC's are detailed below:

USACE

Fragility/reliability/breaching	David Schaaf
Hydraulics and hydrology	Corby Lewis
Consequences	Will Lehman
Data	Andrew Sander

HRW

Fragility	Jonathan Simm
Breaching	Mark Morris
Risk software	Caroline McGahey
Data/consequences	Mike Panzeri